

Idaho National Engineering and Environmental Laboratory

RELAP5-3D Development & Application Status

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Outline

- *Improvements in Version 2.3*
- *Ongoing and future work*
- *Current applications at the INEEL*

RELAP5-3D Version 2.3

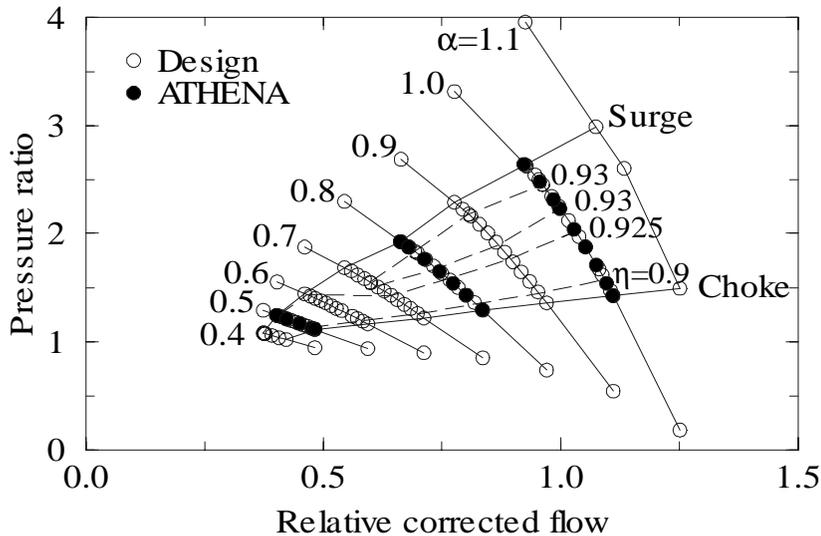
New models and improvements to existing models

- ***Pressurizer spray model***
- ***Feedwater heater model***
- ***Improved steady-state mode***
- ***Hex Krylov kinetics solver***
- ***Multiple system coupling***
- ***Radiological transport model***

Ongoing Work

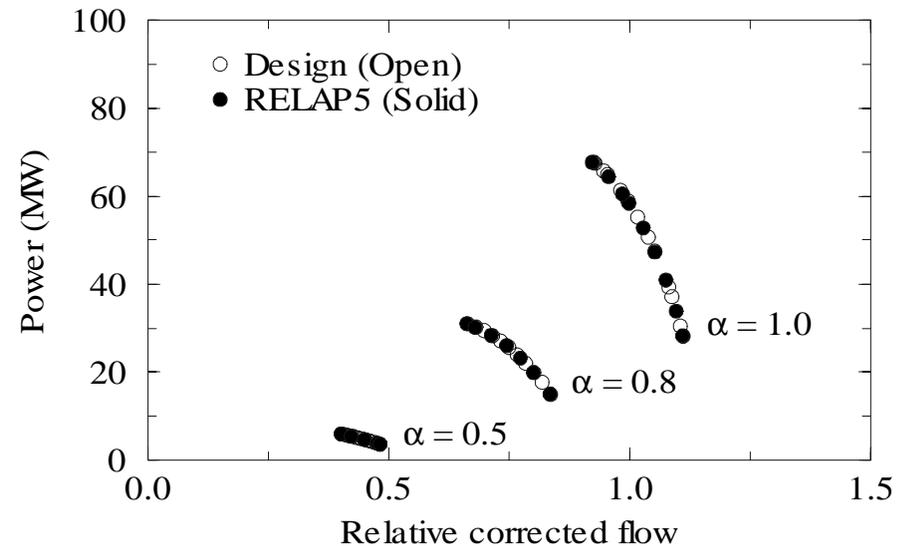
- ***Compressor Model***
- ***FORTTRAN 90 conversion***
- ***Continue conversion of RGUI and TKXMGR to JAVA***

Compressor Model Performance*



← Comparison of design and calculated pressure ratio versus flow

Comparison of design and Calculated power versus flow →



*Developed by Jim Fisher, INEEL

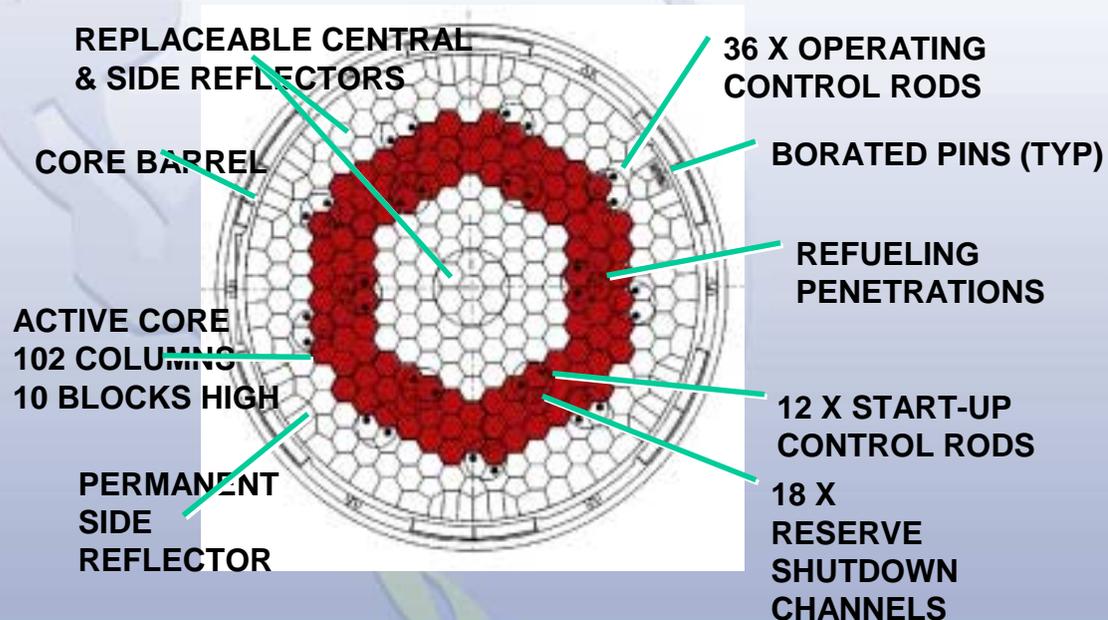
Future Work

Generation IV modeling improvements

- Assess heat transfer models using existing gas flow data***
- Enable heat structures to conduct/radiate heat axially***
- Gas diffusion modeling for air ingress***
- Space reactor modeling improvements***
 - Heat pipe model***
 - Cesium coolant***

Core model for the prismatic NGNP

- *A heat structure models each graphite block*
- *Each heat structure conducts and radiates heat to its neighbors axially and radially*
- *A uniform block temperature is assumed*



Future Work (continued)

- *Continue FORTRAN 90 conversion*
- *Junction flag for Henry-Fauske critical flow model*
- *Improvements to Ransom-Trapp critical flow model*
 - *Restore to published model*
 - *Improve transitions*
- *Programmer's Manual for the PVM coupling methodology*

Current Applications

- ***Generation IV reactor studies***
 - *Next-Generation Nuclear Plant (Very High Temperature Reactor)*
 - *Supercritical Water Reactor*
 - *Gas Cooled Fast Reactor*
- ***Paper Pulp Plant Boiler***

Boiler response to a decrease in steam header pressure

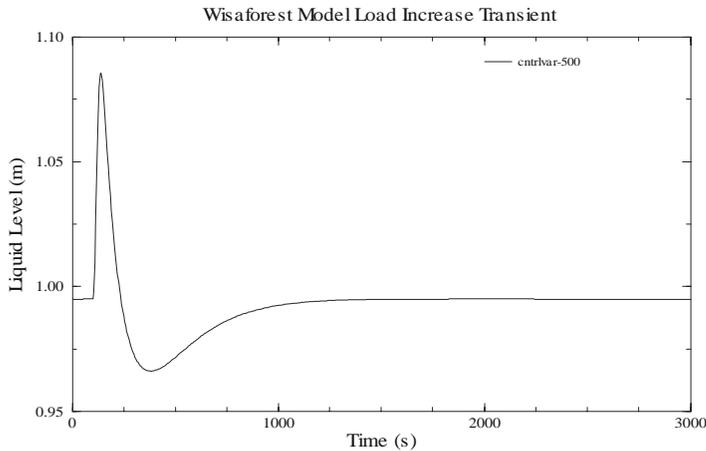
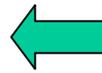


Figure 5. Steam drum collapsed liquid level.



Response of the steam drum level

Steam flow and feedwater flow

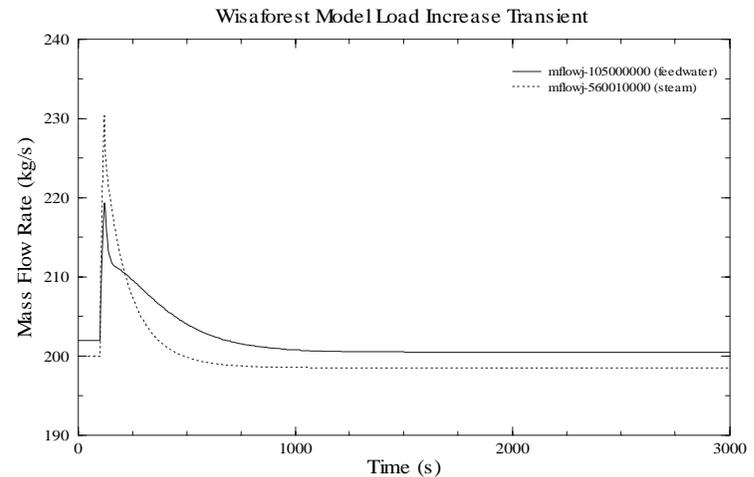
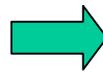


Figure 6. Feedwater and steam flow rates.

Summary

- *New modeling capabilities added*
- *Modernization underway*
 - *FORTRAN 90*
 - *Parallelization*
- *Scope of applications expanding*
 - *Generation IV reactor designs*
 - *Space reactor modeling*